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GB A 2093687

(58) Field of search
A4L
A4J

(54) Reclinable chair

(57) A reclinable chair includes a frame having a front end and a back end, a seat support (39), and a back support (42). The seat support (39) swivels about a pivot axis which is the axis of the front wheels (32) of a carriage (30,32,34,36) which axis traverses along a forwardly and upwardly inclined pathway (18). The back support (42) has a lower end (43) and an upper end (44), being pivoted adjacent its lower end to the seat support (39) and being pivoted at a location spaced above its lower end to one end of a link member (52) of which the other end is pivoted to the frame. In this manner, forward movement of the seat support (39) causes the same to be raised against gravity while the back supp rt (42) reclines, thus storing potential energy in th seat support (39) which can be subsequently tapped to raise th back support (42), while allowing swivelling of the seat support.

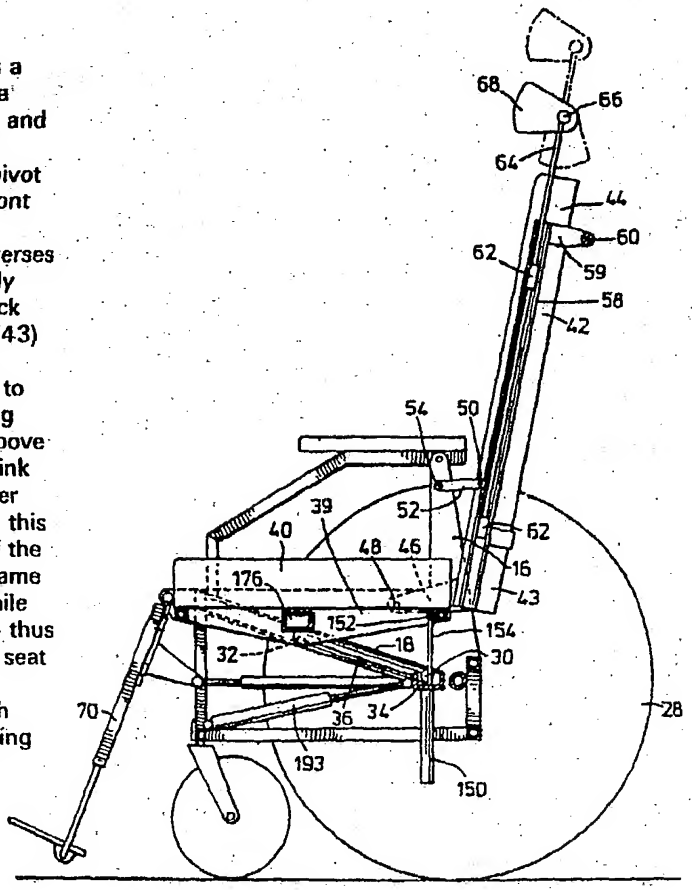

FIG. 1

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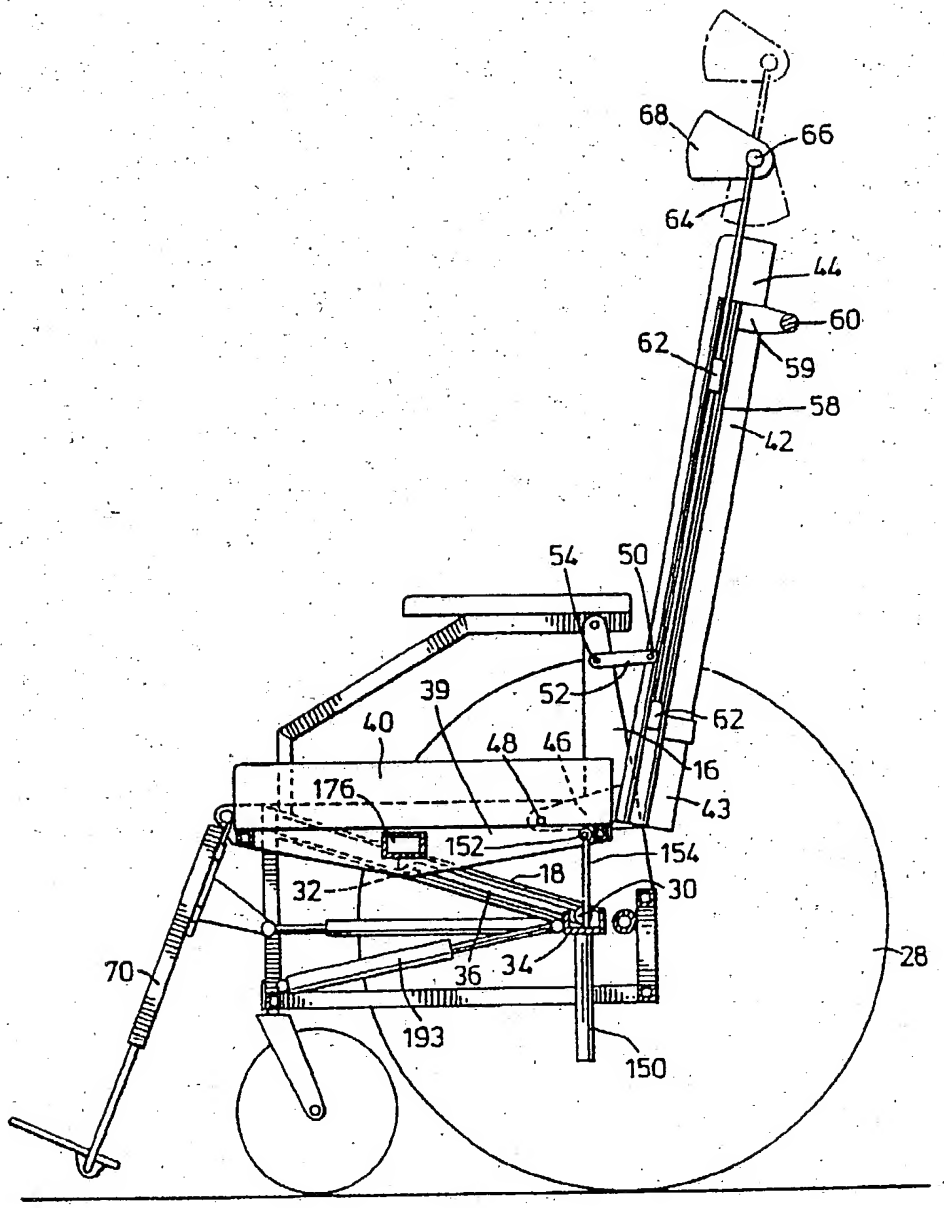
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FIG. 1

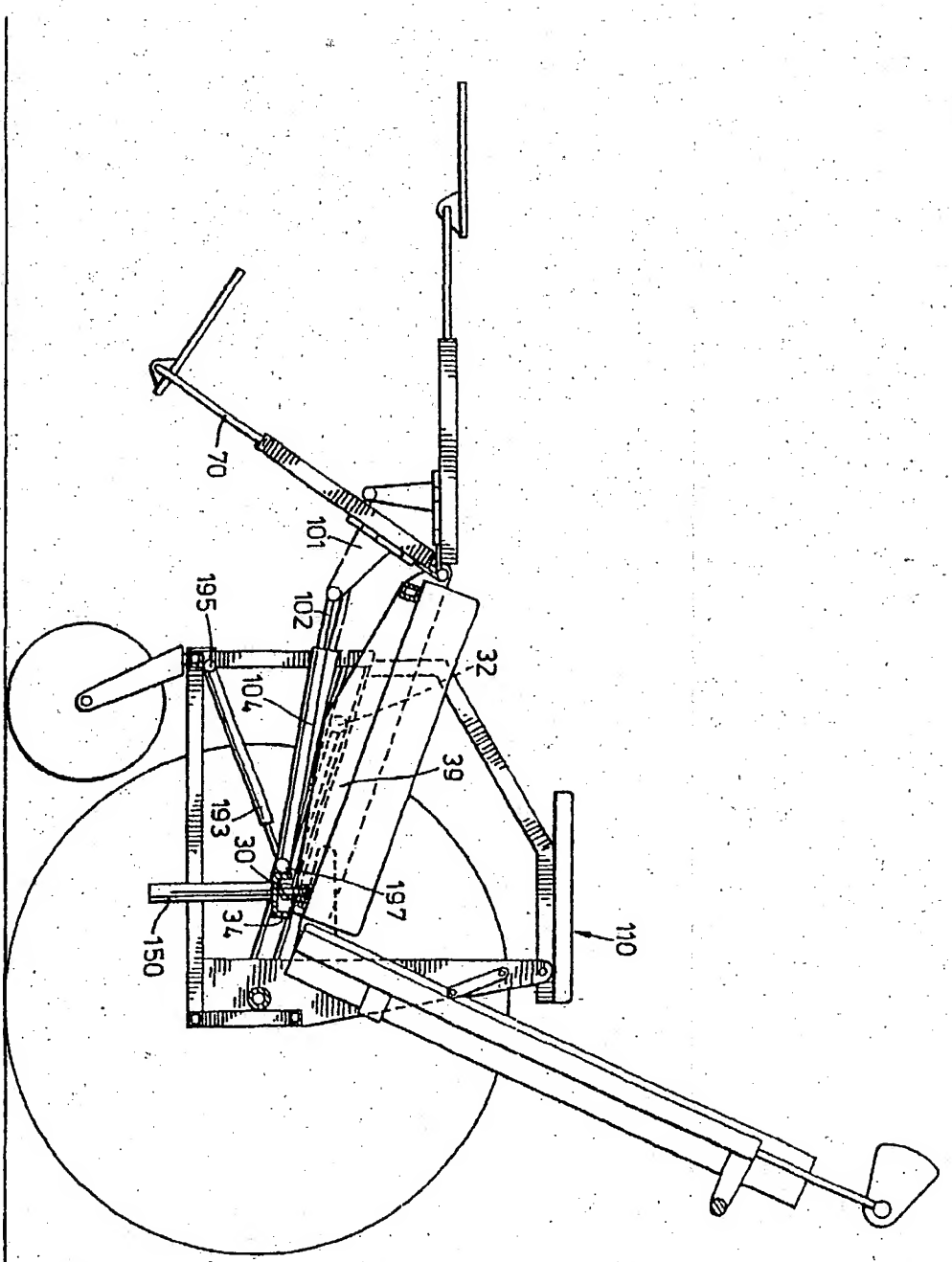

FIG.2

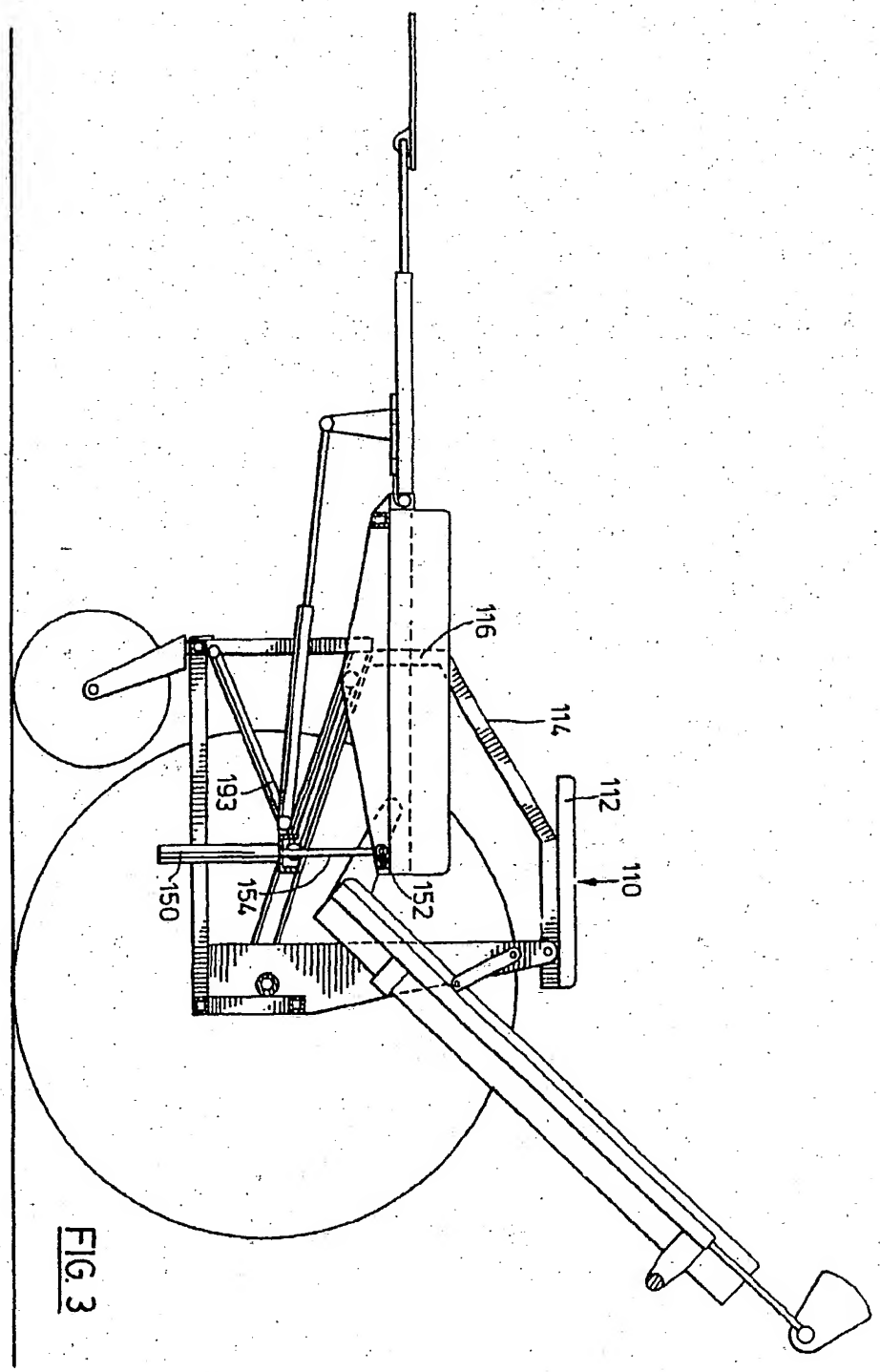

FIG. 3

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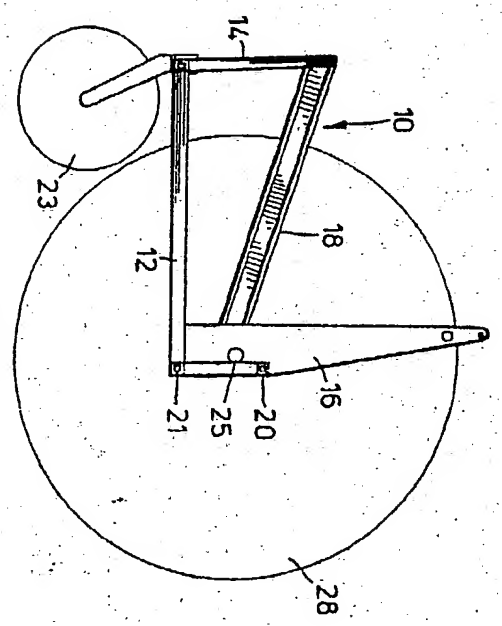

FIG. 4

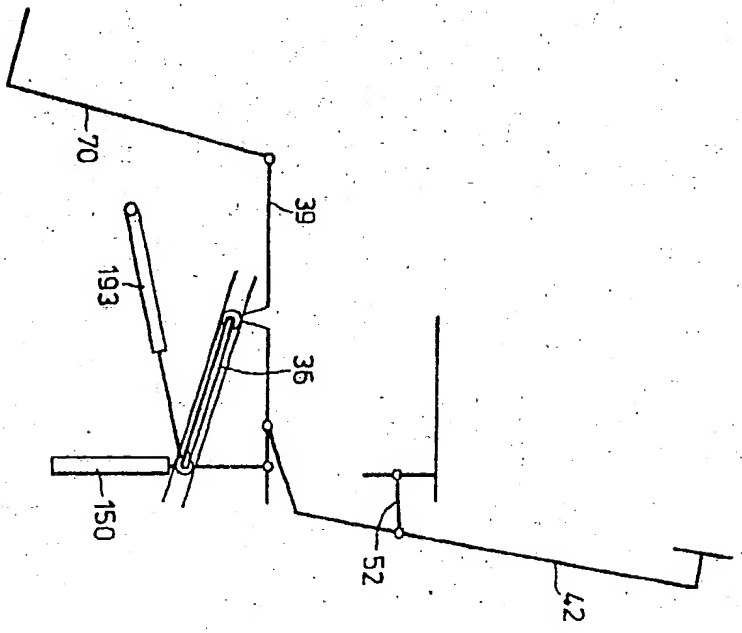

FIG. 5

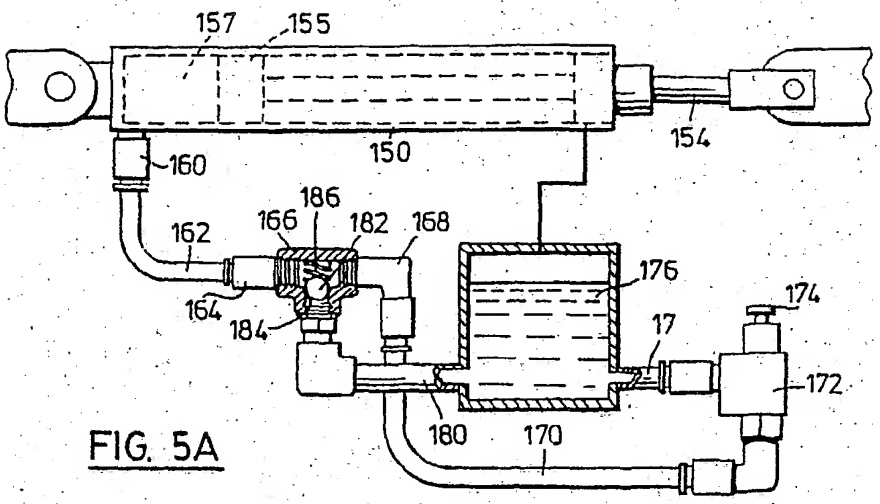
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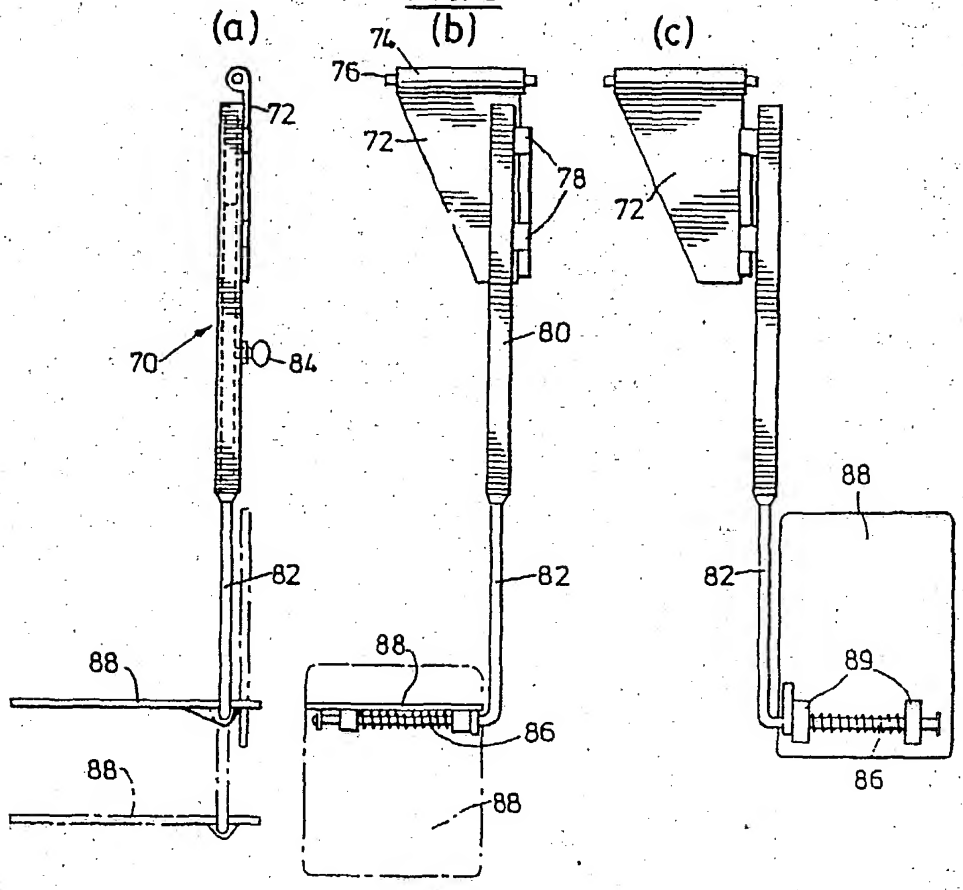
FIG. 5A

FIG. 6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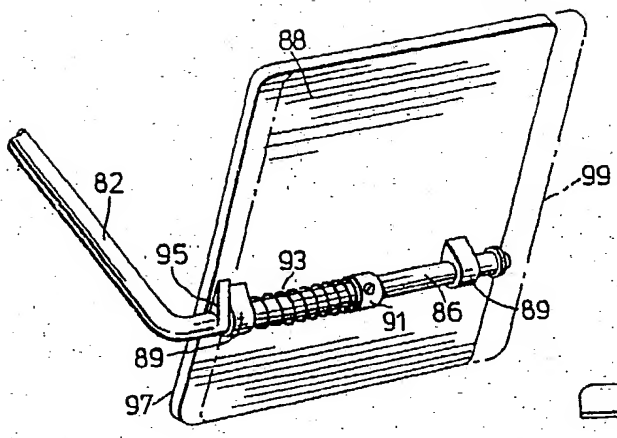
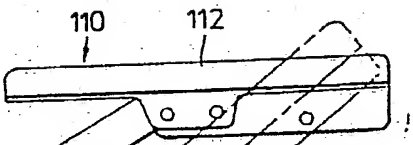


FIG. 7



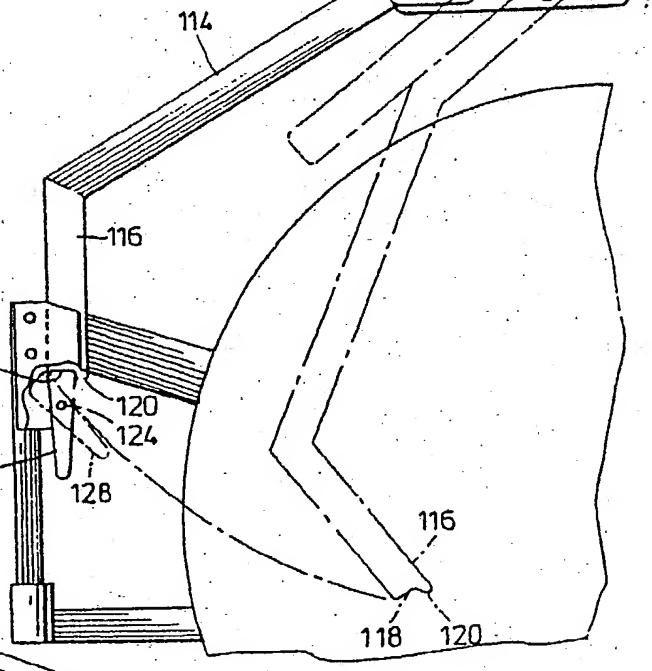


FIG. 8

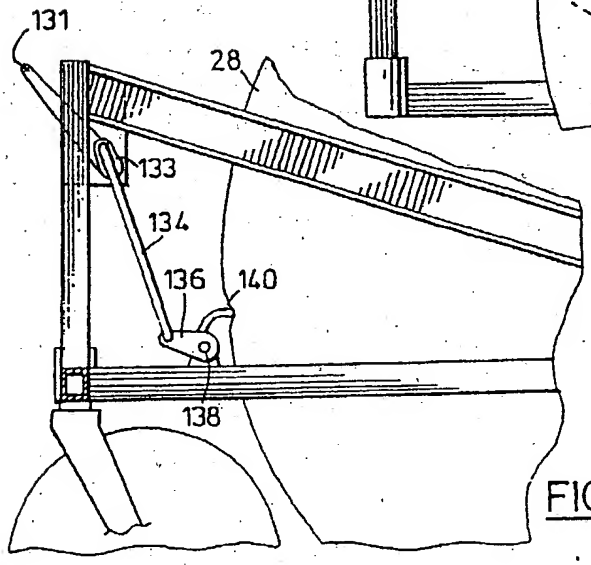


FIG. 9

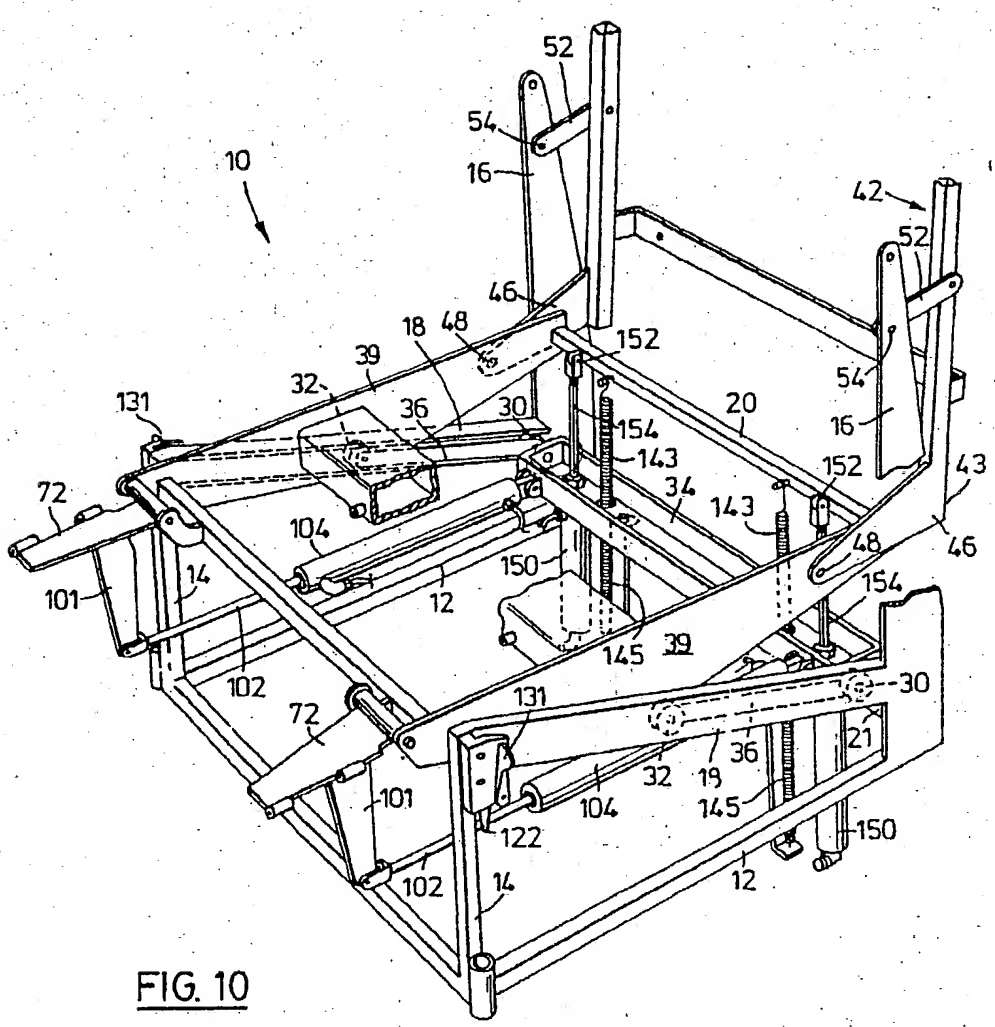

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FIG. 10

SPECIFICATION

User controlled reclining wheelchair

This invention relates generally to seating means in which the user, while seated, can control the attitude of various components of the seating means, and has to do particularly with a user controlled wheelchair, in which the user is able, by shifting his weight and without great strain, to alter the angulation of the seat support member, and to alter the angulation of a back support member.

Many different models of wheelchairs are available on the market at the present time, but most of these offer little or no flexibility in terms of the attitude or angulation of the seat supporting member and the back supporting member. Some simply have a permanent relationship between these two members, which many users find uncomfortable. Disabled persons usually prefer to be able to vary the position of the various members supporting their bodies precisely because they are confined to whatever-contrivance they happen to sitting or lying in, and do not have sufficient use of their muscles to be able to change their condition at will.

Other wheelchairs available on the market, as well as the devices shown in a number of prior art patents, do have a certain amount of flexibility in terms of changing the attitude of the seat support and the back support of a wheelchair or the like, but they are not user-operated in the sense of allowing the user simply to shift his weight and change the position of the support components.

There are units known generically as lazy boy chairs, in which the user may shift his weight and change the position of the chair. However, these chairs tend to have only two or three "preferred" positions, and are unstable in any intermediate positions. Moreover, the construction of the lazy boy chair is unnecessarily complex and costly, and is not directly applicable to the construction of a wheelchair.

In order to allow the user of a reclinable chair to change the angulation of various components merely by shifting his weight, the mechanism by which the different components are interconnected must be such that the amount of potential energy in the system as a whole remains substantially constant, regardless of the position of the chair. This can be more fully understood by taking the example of a chair in which the seat support is fixed, and in which the back support is pivoted at its lower end to the rear of the seat support. It will be readily appr ciated that, for such a system, user operation simply by shifting weight is impossible. Without adequate bracing of the back supp rt, the weight of the user would simply cause the back support to amount of weight shifting on the part of the user would restore the back support to its upright position.

Generally speaking, in order to allow such user-controllability, it is necessary to arrange the interconnection in such a way that the seat component is caused to rise and thus store potential energy (the potential energy of vertical position), while the back support declines and loses potential energy. However, the potential energy of the entire system would remain substantially constant. Then, the user may, simply by pulling forward on arm rests or shifting his general weight forwardly, cause the seat support to lower once again, which through an appropriate linkage restores the back support to its upright condition.

The system just described, while offering a certain degree of flexibility, would not allow the user to both change the attitude of the back support, and change the attitude of the seat support, each independently of the other.

It is an aspect of this invention to permit such independent adjustability of the seat support and the back support, in a chair arrangement in which the user can use his weight alone to change the condition of the various components.

It is also an aspect of this invention to provide lock means, preferably in the form of hydraulic cylinders, which are not powered as such but which are controlled by check valves and manual means so that they act to maintain a component of the seat construction in a given position, until manually released.

Exemplary of the prior art are the following patents:

U.S. 4,367,895, issued January 11, 1983, to Pacitti et al.

U.S. 3,191,990, issued June 29, 1965, to D.E. Rugg et al.

U.S. 3,111,181, issued November 19, 1963, to G.D. Yatich.

U.S. 3,913,152, issued October 21, 1975, to H.M. Quakenbush.

This invention generally provides a reclinable chair which includes a frame having a front end and a back end, a seat support, and a back support. The seat support is adapted to swivel about a pivot axis and means are provided to allow the pivot axis to traverse along a forwardly and upwardly inclined pathway. The back support has a lower end and an upper end. It is pivoted adjacent its lower end to the seat supp rt and is pivoted at a location spaced above its lower end to one end of a link member of which the other nd is pivoted to the frame. In this manner, forward movement of the seat support causes the same to be raised against gravity while the back support reclines, thus storing poten-

subsequently tapped to raise the back support, while allowing swivelling of the seat support.

One embodiment of this invention is illustrated in the accompanying drawings, in which like numerals denote like parts throughout the several views, and in which:

Figures 1, 2 and 3 are somewhat schematic views of the main components of a wheelchair embodying this invention, showing three different mutual angulations of the seat support and back support;

Figure 4 is a schematic view of the primary components of the frame and wheel assembly of the wheelchair of Figures 1-3;

Figure 5 is a purely schematic drawing showing the various mechanical linkages represented by the components of the wheelchair;

Figure 5A is an idealized drawing showing the hydraulic control of one of the several cylinders which the wheelchair of this invention includes;

Figure 6(a), (b) and (c) show three views of a legrest for use with the wheelchair of this invention;

Figure 7 is a perspective view of the footrest utilized in the wheelchair of this invention;

Figure 8 is a somewhat schematic view showing the adjustability of the armrest of the wheelchair according to this invention;

Figure 9 shows the main components of a brake for the wheelchair of this invention; and

Figure 10 is a broken-away perspective view of the main operating elements of the wheelchair.

Attention is first directed to Figure 4, which shows a main frame 10 of a wheelchair to include a bottom strut 12, a front upright strut 14, a back upright strut 16, and a forwardly and upwardly inclined track 18. It will be understood that, in Figure 4, only one of a pair of each of these elements is illustrated. In the actual construction, each of the members just described is duplicated, one on either side of the structure, and suitable brace members, for example cross braces 20 and 21, are provided to rigidify the entire frame. Depending down beneath each of the front upright struts 14 is a swivellable castor wheel 23, and mounted on a horizontal shaft 25 supported adjacent each end by the two back upright struts 16 are two main wheels 28 of conventional construction. The conventional construction includes a metal hand hoop fixed with respect to the wheel proper, which is of smaller diameter and extends laterally out to the side, so that the user can propel the chair by using his arms.

Attention is now directed to Figure 1, which shows, in addition to the fixed frame and wheels, the movable components of the wheelchair.

Firstly, a carriage slidably along the tracks 18 is defined by a first pair of rear wheels 30 and a second pair of front wheels 32. The front wheels 32 are shown in broken lines in Figures 1, 2 and 3. The carriage includes a back cross brace 34 in the form of an upwardly open C-shaped channel, and two arms 36, one located within each track, and each connected between the respective wheel of the two pairs 30 and 32.

Pivotally mounted with respect to the carriage just defined, and more specifically about the axis of the front wheels 32, is a seat support 39, supporting a seat cushion 40. Thus, the pivot axis about which the seat support 39 is swivellably mounted is adapted to traverse along the forwardly and upwardly inclined pathway defined by the tracks 18.

The wheelchair further includes a back support 42 having a lower end 43 and an upper end 44. The back support 42 is pivoted adjacent its lower end to the back of the seat support 39, more specifically by virtue of two forwardly and downwardly projecting brackets 46 which are fixed with respect to the back support 42, and which are pivoted at the point 48 to the seat support 39. Thus the seat support 39 and the back support 42 articulate about the point 48.

The back support 42 is also pivotally connected, at an axis spaced above its lower end 43, to one end of each of two link members 52, of which the other ends are pivoted to the frame at the axis identified by the numeral 54 in Figure 1, more specifically to the upright back struts 16 of the frame already described with reference to Figure 4.

The back support 42 includes side frame members 58 at either side, the members 58 each having at the top a rearwardly extending bracket 59, the brackets 59 supporting a bar 60 by which the wheelchair can be controlled from behind.

At either side of the back support 42 are two collars 62, affixed to a headrest support rod 64. The collars 62 slide frictionally in a respective tubulator or guide element. The two rods 64 journal at their tops a cross rod 66 to which a headrest 68 is affixed. As can be seen in Figure 1, the headrest 68 can thus be raised or lowered, and changed in its angulation.

Pivoted to the front of the seat support 39 are two detachable legrests 70. Referring more particularly to Figure 6, each legrest 70 includes a pivotally mounted bracket 72 defining a knuckle 74 through which a pintle 76 passes for engagement with appropriat knuckl means on the seat support 39. The knuckle 74 is horizontal. Each bracket 72 further defines two vertically oriented and aligned hinge knuckles 78, into which pins proj cting downwardly at the top of the legrest shaft 80 can engage, thus providing a hinged connection. As seen in Figures 6(b)

through at least 180° with this hinge connection. The shaft 80 is preferably hollow and of square section, and receives a rod 82 which can be fixed in position with respect to the shaft by using the thumb screw 84.

The rod 82 undergoes a 90° bend at the lower end, as seen in Figures 6(b) and 6(c), thus defining a horizontal portion 86 to which a footrest 88 is swivellably mounted. Figure 7 shows the connection between the footrest 88 and the bottom of the rod 82 in greater detail. As can be seen in Figure 7, the footrest 88 has two spaced-apart brackets 89 defining a pivot connection with the portion 86 of the rod 82. Secured to the portion 86 is a collar 91, and between the collar 91 and the rightward bracket 89 is a coil spring 93 in compression. Thus, the coil spring 93 is seeking always to drive the footrest 88 to the right with respect to the rod 82.

As can be seen in Figure 7, which is a view looking up from underneath the footrest 88 when it is in its operative condition, with the rod 82 receding away from the viewer, the rod 82 has, at the location of the 90° bend, an integral stop 95 which normally sits beneath the footrest 88 and prevents it from rotating in the counter-clockwise direction as seen looking from the right in the direction of the portion 86. In order to allow the footrest 88 to swivel in the said direction, it must be pushed to the left, against the urging of the spring 93, so that its leftward edge 97 clears the stop 95. The position of the rightward edge of the footrest 88 in the latter condition is shown in broken lines at 99 in Figure 7.

Extending rearwardly from the bracket 72 is a member 101 which is adapted for connection to the end of the piston 102 of a hydraulic cylinder 104 to be described in detail later in this specification. The function of the cylinder 104 is to permit the legrest 70 to be maintained in any given angulated position up from the vertical position to which gravity naturally draws it. The legrests 70 can be adjusted independently of each other.

Turning to Figure 3, the wheelchair further includes two armrests 110, extending in the back-to-front direction on either side of the seat support 39. The two armrests are pivotally mounted to the frame adjacent their back ends for movement between an upper position in which they can support th arms of a user of the wheelchair, and a l wer position in which they are substantially removed from interfering with sideward transfer of the user into and out of the chair. Mor particularly, each armrest includes an arm supporting portion 112 and a brace portion 114 to which the arm supporting portion 112 is affixed. The brace portion 114 extends first forwardly under the arm supporting portion 112, then obliquely downwardly and forwardly from the arm supporting portion 112 and nds with a ment surface as seen in Figure 8, to which attention is directed.

In Figure 8, the abutment portion 118 can be seen at the bottom of the vertical portion 116, the abutment surface being contiguous with a downwardly depending tooth 120.

Pivotally mounted with respect to the frame is a latch member 122 which can be swivelled about an axis shown at 124. The latch member 122 normally hangs by gravity in the vertical position shown in solid lines in Figure 8. However when the brace portion 114 of the armrest 110 swings upwardly, the bottom end of the vertical portion 116 strikes the part of the latch member 122 which is above the pivot point 124, and causes it to angulate into the position shown in broken lines at 128 in Figure 8. This allows the abutment surface 118 to rise above the normal location of the top of the latch member 122, and then as the brace member 114 attempts to swing back downwardly, the abutment surface 118 comes into contact with the latch member 122, and holds the brace portion 114, and thus the armrest 110, in the position shown in solid lines in Figure 8.

Attention is now directed to Figure 9, which illustrates the operation of the brakes, for which one is provided for each of the main wheels 28. A lever 131 is adapted to activate a cam 133 which in turn lifts a connecting rod 134, in turn raising a lever 136 pivoted at 138 to the frame, the lever 136 having affixed thereto a braking member 140 which is pressed into the wheel 28 thus preventing rotation of the same.

Figure 10 provides a perspective view of the main operational components already described with reference to Figures 1-3, and additionally shows the position of optional tension assist springs 143, each secured between the cross brace 20 and the lower end of a bracket 145 which is bolted to the back cross brace 34.

Attention is now directed to Figures 1, 2 and 3, for a description of the way in which the hydraulic lock means operates.

Because it can often happen that the most comfortable position in a chair of this kind is one in which the support components are resisting the tendency of the natural weight distribution of the body to shift the positions of the components, it is desirable to provide some lock means which can be easily and manually controlled by the user, in ord r to allow him to lock the main supporting c mponents into a desired position, once reached.

It is conceivable that locking means could be provided to lock each component against movement in both directions, or in one direction only. In what follows, a system will be describ d which is a one-way locking system only, although it will be evident to those skilled in the art that the syst m could be modified only slightly in order

to make it capable of locking the support components against movement in both directions.

In Figure 2, there are shown two vertical hydraulic cylinders 150, which are secured below the U-shaped cross brace 34, and which have their piston rods extending up to pivot connections 152 (see Figures 1 and 3) on the seat support 39 spaced rearwardly from the pivot axis defined by the axis of the pair of wheels 32. Thus, since the carriage defined by the cross brace 34, the wheels 30 and 32 and the rods 36 is always in the same angular attitude with respect to the horizontal, pivoting of the seat support 39 with respect to its pivotal axis will cause the piston rod 154 of the cylinder 150 to move inwardly and outwardly. For example, in Figures 1 and 3 the piston rod 154 is at maximum extension, whereas in Figure 2 it is fully retracted with respect to the cylinder 150.

The basic components of a suitable manually controllable system for operating the hydraulic cylinder 150 as a locking mechanism are shown in Figure 5, although it is to be understood that the geometric relationship of the components of Figure 5 would not be that found in the wheelchair. The purpose of Figure 5 is to illustrate the basic hydraulic connections and the form of the basic components.

In Figure 5A, the cylinder 150 is illustrated at the top, the piston rod 154 is seen, and the piston itself is illustrated in broke lines at 155. To the left of the piston 155 is a closed volume 157 which shrinks as the piston rod 154 moves leftwardly, i.e. retracts, into the cylinder 150. Access to the volume 157 is had through connector 160, from which a hydraulic line 162 leads to a connector 164 which in turn is connected to the downstream side of a one-way check valve 166. Also opening into the downstream side of the check valve 166 is a connector 168, from which a hydraulic line 170 leads to the upstream side of a manually releasable valve 172 having a push button actuator 174. The downstream side of the valve 172 is connected back to a reservoir identified by the numeral 176 in Figure 5, through a hydraulic line 178. Another hydraulic line 180 leads also from the reservoir 176 to the upstream side of th one-way check valve 166. Inside the one-way check valv 166, a fr e ball 182 is adapted to seat against an opening 184, and is retained close to the opening 184 within a cage defined by a spring 186.

In operation, it will be seen that when the piston rod 154 is withdrawn from the cylinder 150, hydraulic fluid can pass from the reservoir 156 through the lin 180 and the check valve 166, thence through hydraulic line 162 and connector 160 into the volume 157.

However, any attempt to push the piston [illegible] shrink the volume 157 will close the one-way check valve and prevent return of the hydraulic fluid along line 180. Instead, the fluid will seek to pass through the line 170 but will be prevented by the valve 172 unless the actuator 174 is depressed. Upon depression of the actuator 174, the fluid can pass from the volume 157 back into the reservoir 176, thus allowing retraction of the piston rod 154.

The volume to the right of the piston 155 in Figure 5 is connected to a leakage return line leading back to the reservoir 176.

By mounting the actuator 174 at some easily accessible location on the armrest 110, it will be understood that the user of the wheelchair will be able to unlock the cylinder 150 while he adjusts the position of the seat support 39, and then can lock the seat support against clockwise rotation as seen in Figures 1 and 2. As previously mentioned, it would be a simple matter to make both ends of the hydraulic cylinder 150 lockable by separate controlling actuators, in order to have a fully lockable condition.

Looking at Figures 1 and 2, a further hydraulic cylinder 193 is also provided, located centrally under the seat support 39. The hydraulic cylinder 193 is connected at one end to the frame 10 at the pivot point 195, and the opposite end of the piston rod is connected at 197 to the cross brace 34 of the carriage defined earlier. Thus, as the seat support 39 and the carriage move leftwardly up the pathway defined by the tracks 18, the piston rod of the cylinder 193 retracts into the cylinder. By connecting the cylinder 193 in a circuit the same as that shown for the cylinder 150 in Figure 5, a separate actuator button would be depressed in order to allow forward and upward movement of the seat support 39. Upon release of the actuator for the hydraulic cylinder 193, no further forward or upward motion of the seat support 39 would be possible.

Finally, the wheelchair includes the two previously-mentioned hydraulic cylinders 104, of which the piston rods are connected to the members 101 of the legrests 70. The cylinders 104 would also be controlled in separate circuits the same as that shown in Figure 5, with separate actuators similar to the actuator 174. To adjust the position of the legrest 70, the legrest would simply be pulled out to the desired angulation, and then the respective cylinder 104 would hold the legrest in that position so long as th actuator were not depressed. To return the legrest 70 to a lower or to the vertical p sition, it is simply a matter of pressing the appropriate actuator and allowing gravity to take the footrest down to the desired positi n.

It is to be understood that, optionally, the entire hydraulic system could be pressurized to perhaps 1-2 psig, which would allow the legrests to be self-raising whenever no leg

weight were applied to them.

While one embodiment of this invention has been described hereinabove and shown in the attached drawings, it will be apparent to those skilled in the art that changes and modifications could be made thereto, without departing from the essence of this invention, as set forth in the appended claims.

CLAIMS

1. A reclinable chair comprising:

a frame having a front end and a back end,

a seat support adapted to swivel about a pivot axis,

means allowing said pivot axis to traverse along a forwardly and upwardly inclined pathway,

a back support having a lower end and an upper end, the back support being pivoted adjacent its lower end to the seat support and being pivoted at a location spaced above its lower end to one end of a link member of which the other end is pivoted to the frame,

whereby forward movement of the seat support causes the same to be raised against gravity while the back support reclines, thus storing potential energy in the seat support which can be subsequently tapped to raise the back support, while allowing swivelling of the seat support.

2. A chair as claimed in claim 1, in which the reclinable chair is part of a wheelchair, said frame having attached thereto a pair of rear wheels and a pair of front wheels.

3. A chair as claimed in claim 1, in which the pivot axis is located substantially midway of the seat support, taken in the front-to-back direction.

4. A chair as claimed in claim 1, in which said location on the back support is in the lower half of the back support.

5. A chair as claimed in claim 1, in which said means comprises an inclined, substantially rectilinear track fixed with respect to the frame, and wheel means riding in said track, the wheel means being attached to a carriage on which the seat support is pivoted to define said pivot axis.

6. A chair as claimed in claim 2, which further comprises two legrests pivoted about horizontal axes to the front of the seat support, and lock means for selectively locking the legrests into various angulated positions with respect to the seat support.

7. A chair as claimed in claim 6, in which said lock means includes, for each legrest, a fluid cylinder connected betwe n a first point or a carriage riding along said pathway and moving with said pivot axis, and a second point fixed with respect to the legrest.

8. A chair as claimed in claim 5, which further comprises first lock means for selectively preventing rotation of the seat support about said pivot axis with respect to the second lock means for selectively preventing movement of said carriage along said track in at least one direction.

9. A chair as claimed in claim 1, which further comprises first lock means for selectively preventing rotation of the seat support about said pivot axis with respect to the frame in at least one rotational sense, and second lock means for selectively preventing movement of said pivot axis along said pathway in at least one direction.

10. A chair as claimed in claim 8, in which each said lock means includes at least one hydraulic cylinder having means for admitting oil to one end through a check-valve from a reservoir, and manually controllable valve means for allowing the oil to return from said one end to said reservoir.

11. A chair as claimed in claim 9, in which each said lock means includes at least one hydraulic cylinder having means for admitting oil to one end through a check-valve from a reservoir, and manually controllable valve means for allowing the oil to return from said one end to said reservoir.

12. A chair as claimed in claim 11, which further comprises two legrests pivoted about horizontal axes to the front of the seat support, and third lock means for selectively maintaining the legrests in various angulated positions with respect to the seat support, said third lock means including, for each legrest, a hydraulic cylinder connected between a first point on a carriage riding along said pathway and moving with said pivot axis, and a second point fixed with respect to the legrest, said last-mentioned hydraulic cylinder having means for admitting oil to one end through a check-valve from a reservoir, and manually controllable valve means for allowing the oil to return from said one end to said reservoir.

13. A chair as claimed in claim 12, in which said at least one hydraulic cylinder of said first lock means is connected between a location on the seat support spaced from said pivot axis and a location on said carriage; and in which said at least one hydraulic cylinder of said second lock means is connected between a location on said frame and a location on said carriage.

14. A chair as claimed in claim 13, in which the reclinable chair is part of a wheelchair, said frame having attached thereto a pair of rear wheels and a pair of front wheels.

15. A chair as claimed in claim 2, further comprising two armrests extending in the back-to-front direction on either side of said seat support, th armrests being pivotally mounted to th frame adjacent their back ends for movement between an upper position in which th y can support the arms of a user of the wheelchair, and a lower position in which they are substantially removed from interfering with sideward transfer of the user

16. A chair as claimed in claim 15, in which each armrest includes an arm supporting portion and a brace portion to which the arm supporting portion is affixed, the brace portion extending forwardly and obliquely downwardly from the arm supporting portion and terminating in an abutment surface adapted to lodge above a latch member pivoted to the frame, which latch member can be swivelled either manually to release the abutment surface so that the armrest can go to its lower position, or automatically by being struck by the brace portion as the armrest moves toward its upper position.

17. A chair as claimed in claim 1 and substantially as hereinbefore described with reference to, and as shown in the accompanying drawings.

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